BARRE FALLS DAM

BARRE, MASSACHUSETTS

FOREST MANAGEMENT PLAN

MASTER PLAN APPENDIX B

AND

FISH AND WILDLIFE MANAGEMENT PLAN

MASTER PLAN APPENDIX D

Department of the Army
New England Division, Corps of Engineers
Operations Division
Waltham, Massachusetts

January 1981

DISPOSITION FORM

For use of this form, see AR 340-15; the proponent agency is TAGO.

REFERENCE OR OFFICE SYMBOL	SUBJECT
DOD-P	Master Plans, Appendices B & D, Forest and Fish and Wildlife Management Plan, Barre Falls.

TO	FROM	DATE	CMT 1
See Distribution	Chief, Operations Division	21 April 1981 Mr. Mitchell/bp/305	

1. The subject appendices, prepared in accordance with ER 1130-2-400, dated May 1971, has been approved by the Division Engineer.

2. The plan has been developed to increase the value of reservoir lands for recreation and wildlife, and to promote natural ecological conditions by following accepted conservation practices.

3. This plan has been developed in coordination with the Massachusetts Division of Fisheries and Wildlife, The U.S. Fish and Wildlife Service and the Metropolitan District Commission.

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Distribution:
(2) HQDA (DAEN-CWO-R)
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(5) Project Manager, Barre Falls
(5) Massachusetts Division of Fisheries and Wildlife

12/28/81

DA FORM 2496 PREVIOUS EDITIONS WILL BE USED

DISPOSITION FORM

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REFERENCE OR OFFICE SYMBOL	SUBJECT
NEDOD-P	Master Plan, Appendices B and D, Forest and Fish and Wildlife Management Plan, Barre Falls Dam

TO	FROM	DATE	CMT 1
Acting Division Engineer	Chief, Operations Division	29 January 1981 Mr. Mitchell/kp/305	

1. Inclosed for your approval is the Forest and Fish and Wildlife Management Plan for Barre Falls Dam. This plan will serve as Appendices B and D to the Master Plan for this project.

2. It has been prepared in conjunction with ER 1130-2-400, dated 28 May 1971. It has been revised by NED Planning, Engineering, and Real Estate Divisions; and the Massachusetts Division of Forests and Parks; and Fish and Wildlife. Appropriate changes have been incorporated.

3. Division Engineers have been designated as approval authority for these plans by ER 1130-2-400. Information copies are to be forwarded to OCE upon approval.

ANDRELIUNAS

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as

CF: Opers Div File

TO: Chief, Operations Division FROM: Acting Division Engineer DATE: 30 January 1981 CMT 2

[✓] APPROVED [ ] DISAPPROVED

WILLIAM E. HODGSON, JR.
Colonel, Corps of Engineers
Acting Division Engineer

DA FORM 1 FEB 62 2496 REPLACES DD FORM 96, WHICH IS OBSOLETE.

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ACKNOWLEDGMENTS

The Corps of Engineers, New England Division, wishes to thank Jan Szwed and Frederic Magee for their effort in developing this natural resource management plan.

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SECTION 1. INTRODUCTION

Purpose

The land and forests of Barre Falls Dam are valuable assets to the surrounding areas providing recreational opportunities and preserving natural areas in public ownership as well as protecting the rivers and streams within the flood control project. The intelligent management of these lands and forests according to sound ecological principles will insure their existence for future generations and their continued productivity.

The purpose of this management plan is to provide a general description of the resources contained within the project boundaries and to provide interm guidelines on the general techniques to be used to manage the forest, fish and wildlife resource. This plan is designed to be reviewed and revised on a regular basis.

Authority

This forest and fish and wildlife management plan is an essential appendix to the project master plan authorized under ER 1130-2-400, dated 28 May 1971.

Management Objectives

The objectives of this management plan are to outline management practices which are compatible with flood control operations and multiple-use practices at Barre Falls Dam, and to provide for the proper ecological management of forest, fish and wildlife resources.

Specific objectives are:

- Protect and enhance natural beauty.
- Develop wildlife habitat to attract and support the greatest variety of naturally occurring species.
- Provide for recreational use of project natural resources including hunting, fishing, nature observation, and other day use.
- Provide wood products for project and commercial purposes.

Coordination

This plan has been coordinated with the Massachusetts Division of Fisheries and Wildlife, the U.S. Fish and Wildlife Service, and the Metropolitan District Commission.

SECTION 2. PROJECT DESCRIPTION

Location

Barre Falls Dam is located on the Ware River in the towns of Barre, Hubbardston, Oakham, and Rutland, Worcester County, Massachusetts. The dam is 31.9 miles above the confluence of the Ware and Swift Rivers, both tributaries of the Chicopee River, and 49.8 miles above the confluence of the Chicopee River with the Connecticut River at Chicopee, Massachusetts. During periods of floodwater impoundment the reservoir extends upstream in the Ware River drainage basin along the East Branch and its tributaries, Stevens Brook and Longmeadow Brook, and along the West Branch. Access to the dam is from Massachusetts Route 62.

Acquisition

Barre Falls Dam and Reservoir was authorized as a project for the Chicopee River Watershed in the Flood Control Act of 18 August 1941 (Public Law No. 228, 77th Congress) and of 22 December 1944 (Public Law No. 534, 78th Congress). Total area of the reservoir is 2,407 acres, of which 557 acres were purchased in fee and 1,850 acres are held in flowage easement. Construction began in 1956 and was completed in May 1958. The total cost was $2,030,000. The majority of the land was previously owned by the Metropolitan District Commission (MDC). The MDC owns and operates the Coldbrook Diversion Intake for the diversion of water from the Ware River into the Quabbin Aquaduct for public water supply to metropolitan Boston.

General

Barre Falls Dam is a dry bed reservoir with a 24,000 acre-foot capacity. The spillway crest elevation is 807 ft. msl. In April 1960, 50% of the storage capacity was utilized with a recorded elevation of 798 ft. msl.

Approximately 80% of Barre Falls is forested. Most of the project's land is forested with native hardwood species with some red pine plana-tions and white pine groves. Swamp and marshland occupys the low-lying lands and are subject to frequent inundation.

History

The area surrounding the project is mainly agricultural with small isolated farms scattered throughout the hills and valleys. Many abandoned farms are being reclaimed by the forests.

SECTION 3. PHYSICAL AND ECOLOGICAL CHARACTERISTICS

Topography

The general topography of the Barre Falls Dam is low with gentle rolling hills and upland plains. The area has naturally occuring lakes and ponds.

The Ware River is formed by the confluence of its East and West Branches in the town of Barre, Massachusetts, and flows in a generally southwest direction approximately 34 miles to its junction with the Quaboag River. The river falls about 450 feet in this distance. Total drainage area at its mouth, including 216 square miles from the Swift River watershed, is 435 square miles. Hills are prominent in the basin, and valleys formed by the Ware River are generally steep and narrow and conducive to rapid runoff.

Flows from the upper 55 square miles are controlled by Barre Falls Dam, and additional control for the Ware River is affected by the MDC diversion works at Coldbrook four miles below Barre Falls Dam.

Climate

The drainage basin of the Chicopee River and its tributaries lies in the path of the prevailing "westerlies" and weather influences from the southwest. The area is exposed to occassional coastal storms some of hurricane intensity which travel up the Atlantic seaboard. The storms constitute an infrequent but critical potential for flood-producing precipitation, especially from August to October.

The average annual temperatures in the area vary from 45°F in the hills to 55°F in the valleys. Recorded temperature extremes in the Chicopee basin have varied from a maximum of 100°F to a minimum of -20°F. The growing season lasts from early May to late September.

Mean annual precipitation is about 40 inches in the headwaters area of the Ware River, with a recorded maximum of about 54 inches and a minimum of 26 inches. The mean annual snowfall is about 55 inches, equivalent to about 5.5 inches of water content. Average annual runoff from the Chicopee River drainage basin is equivalent to 22.2 inches per year, or nearly one-half of the average annual precipitation in the basin.

Geology and Soils

Depth to the bedrock averages 100 feet except in the vicinity of the Barre Falls Dam where bedrock rises rapidly to meet the East end of the dam, and continues westward at a depth of 10 feet below the surface. Glaciation has modified the bedrock formations with deposits of glacial outwash and debris.

Since the glacial epoch, the mantle has been modified by weathering, erosion, and drainage conditions. These young soils vary according to glacial drift and have not changed much from the parent material. A typical characteristic is incompletely developed profiles. The slow rate of the soil-making processes is due to low summer temperatures and the length of time frozen soil remains under a snow pack. Slight podzolization or soil horizon development has occurred in elevated sandy soils. The predominately brown color of the soils in this area is due to the oxidation of iron and the accumulation of organic material.

The soils found within the Barre Falls Dam and Reservoir area are in the Hinckley, Paxton, Brookfield, and Merrimac Series. Also found within the area are Muck and Peak deposits consisting of well-decomposed organic matter, rough, stony land not suitable for agriculture, and meadows of overflow land with poor drainage.

Hinckley soils have been deposited near the edges of the receding glacier as outwash materials, or kames, characterized by a hummocky topography. These soils occur in scattered areas and support such forest vegetation as white pine, white and gray birches, poplar, and scrub oak. Hinckley gravelly sandy loam, has dark brown surface soils, brown subsoils, and sandy substrata with gravel that is made of rounded and water-worn fragments of quartz, granite and gneiss. The internal drainage of this soil type can be excessive in dry seasons.

Paxton loam occurs in drumlins with smooth, rounded, or sloping surfaces fairly free from stones. The soil is characterized by a dark brown surface soil, a greenish-yellow or greenish-gray heavy subsoil and substratum. It is a strong soil that will hold moisture in dry seasons and often has a hardpan layer. It is derived from deep glacial deposits of mixed materials, including schists, slate, or phyllite and granite.

The Brookfield loam and stony loam in this area is one of the strongest soils in the county. It is derived from shallow glacial fill and is found on level to undulatory surfaces having good drainage. Brookfield soils have a characteristic dark rusty-brown surface soils with ocherous-yellow medium textured subsoils. It is derived from rusty-brown schist with a quantity of iron pyrites, giving it the peculiar ocherous color. The Brookfield stony loam is ledgy, containing slabby pieces of schist, and is mostly forested. The Brookfield loam subsoil is rusty-colored, firm and gritty. Most of the loose surface stones have been piled into fences. This soil supports the second growth forest of oaks, hard maples, and birches.

Soils in the Merrimac Series found in Barre Falls, gravelly sandy loam and sandy loam, are derived from gray granites, gneiss, and other crystalline rocks that have been deposited on level, well-drained terraces. Characteristic of these soils is a dark-brown surface, yellowish-brown mellow subsoils, and gray, loose, and friable gravelly substrata. The Merrimac gravelly sandy loam substrata is made of beds of

assorted sand and gravel composed of quartz, granite or slate. The gravel on the usually level surface acts as a mulch to conserve moisture. The materials were deposited along rapidly moving streams emerging from the retreating glacier. The Merrimac sandy loam type was derived from similar glacial and terrace deposits but were laid down the under rather shallow moving water. The level terraces tend to be droughty in dry seasons and deficient in organic material. This soil supports forest cover of white pine, birch, and oak.

Land Classification

Two separate parcels of land are owned by the Federal Government at Barre Falls Dam. The two parcels have been designated as Compartment 1 and Compartment 2 for purposes of orientation and administration. The dam, utility building, operators quarters, and Water Quality Laboratory are located in Compartment 1. Three flood control dikes are located in Compartment 2.

Productive forest types comprise 459 acres of the 557 acres of Government-owned land at Barre Falls. Aerial photographs were used to delineate types and separate them by the relative amount of hardwood or softwood trees, by height class, and by percentage of crown closure. Forest types were named according to the guidelines from Forest Cover Types of North America, published by the Society of American Foresters.

Forest cover types and other land classifications are shown on Map 2 (Exhibit B).

Forest Types

Seven forest types are found at Barre Falls. The most extensive is white pine (type 21) covering 143 acres. A charcteristic stand of this type consists mainly of eastern white pine (Pinus strobus) occupying the overstory as the dominant tree in the canopy. Associated with this type on light soils are bigtooth and quaking aspen (Populus grandidentata and P. tremuloides), red maple (Acer rubrum), grey birch (Betula populifolia), white oak (Quecus alba), and pitch pine (Pinus rigida). On heavy soils, black cherry (Prunus serotina) and northern red oak (Quercus rubra) are associates. Though this type grows best on upland sandy loams, it can occur in swamply areas on clay soils, with red spruce (Picea rubens) as an associate.

White pine is often the first species to appear after abandonment of agricultural fields, which has occurred on numerous occasions in New England. It is a long-lived, yet subclimax forest type. White pine seldom succeeds itself, except in the case of fire or because of silvicultural treatments.

The second most extensive type comprising 110 acres is type 20, white pine-northern red oak-white ash. This type occurs generally on well-drained fertile deep soils. Little if any white ash (Fraxinus americana)

is present. White pine and red oak are the dominant trees of the canopy. Red maple is the chief associate. Also found in this type are white oak, black cherry, paper and yellow birch (Betula papyrifera and B. alleghaniensis), bigtooth aspen, and others in minor amounts. Eastern hemlock (Tsuga canadensis) appears in stands of a later successional stage.

This type often follows "old field" white pine succession, which in turn is followed by a white pine-hemlock type or northern hardwoods-hemlock type.

Red pine plantations occur on 102 acres in Barre Falls. Red pine (Pinus resinosa) is usually pure or predominate in mixtures with white or pitch pines. Black cherry is a subordinate species. This type occurs on sandy and gravelly locations or any dry sandy loam soils with little understory vegetation.

Fifty-two acres consist of type 16, aspen. It is generally a pioneer type occurring on burns, clearcuts, or abandoned fields, and is usually succeeded by white pine and northern hardwoods. At Barre Falls, bigtooth and quaking aspens are often in mixtures with eastern white pine, black cherry, red maple, and grey birch.

White oak-northern red oak-hickory (type 52) occurs on 23 acres. This is a mixed oak type that is widespread in the Central Forest region of the U.S. It occurs on well-drained upland soils and is usually succeeded by sugar maple (Acer saccharum). At Barre Falls white oaks and northern red oaks predominate, along with pines and black oaks (Quercus velutina). Rarely are any hickories (Carya spp.) present.

A variant of the northern hardwoods, type 25, sugar maple, beech-yellow birch, occurs on 17 acres. Sugar maple and yellow birch occurs in patches on moist and fertile loamy soils. Associates are paper birch, black cherry, and eastern white pine.

Gray birch-red maple (type 19) occurs on 9 acres as a pioneer stand on a light class of soils. Gray birch and red maple predominate in mixture with chief associates of quaking and bigtooth aspen. White oak, northern red oak, red maple, and eastern white pine are subordinate. This type is short-lived and usually succeeded by eastern white pine or other hardwoods.

The last type that occurs is type 23, hemlock. It is found on only 3 acres. Eastern hemlock is predominate along with some red maple, and red and white oaks as associated species. This type is generally considered to be a climax forest.

A detailed break-down of acreages for the various forest types and land classifications can be found in Exhibit A, Table 1.

Forest Inventory

A timber cruise was conducted during June 1980. Aerial photos were used to delineate forest types as to softwood versus hardwood stands, height class, and stocking or percentage of crown closure.

Variable radius plots were taken using a Cruise-All with a 10 basal area factor, and a diameter tape was used in measuring tree diameters at breast height.

Tables 2 and 3 (Exhibit A) give estimates of timber volume by forest type and by species for each compartment.

Table 4 gives the total estimated board feet of timber on the project. The estimates were arrived at based on the International 1/4 inch rule and Girard form class 78, with modifications where appropriate based on experience.

SECTION 4. FOREST MANAGEMENT

Factors Influencing Forest Management

Several factors influence the management of forest resources at the Barre Falls Dam. These factors need to be considered and evaluated when developing viable programs for forest management that will minimize adverse effects and optimize the benefits obtainable from the project resources.

Tree Diseases and Insect Pests

The major insect pest occurring at the project is the gypsy moth (Porthetria dispar). Tree damage is generally limited to oaks, grey birch and quaking aspen. The catepillar stage of the insect feeds on the leaves and may cause complete defoliation. The number of trees killed by this defoliation is actually a small percentage of those stripped of their foliage. However, repeated defoliation may seriously weaken trees, especially on low quality sites, and make them susceptible to secondary attack by other insects or plant diseases. Native natural enemies do not exist in large enough numbers or kinds to effectively check the gypsy moth. Should local communities or the State of Massachusetts plan to initiate a spray program in the area then the possibility of Corps involvement will be explored.

No widespread disease or insect problems were observed in the forest stands at Barre Falls Dam. The maintenance of a healthy, vigorous forest containing a variety of tree species and age classes will help insure against any large scale damage caused by these two agencies.

Soil Erosion

The only areas of active soil erosion at the project are in the sand areas along Dikes 2 and 3 in Compartment 2. Off-road vehicle use on these areas has resulted in their being devoid of vegetation. The Corps, along with the MDC and the Massachusetts Division of Fisheries and Wildlife, has placed vehicle barriers on roads leading into the area and the situation has improved to the point where it has become practical to perform rehabilitative work.

Flood storage operations have not contributed to soil erosion at the project.

Decisions on forest management activities will be guided by considering erosion potential. Unstable river bank areas and steep slopes need to be protected; the management of these areas will be directed toward protecting the soil by maintaining good vegetative cover.

Access

Thinning, fuelwood cutting, and timber harvesting are dependent in part on the availability of suitable access for removing forest products. The project has an extensive system of gravel roads. No new construction is planned.

Flood Control Operations

Operation of the Barre Falls Dam can affect, and also be affected by, forest management activities in the reservoir area. Flood control operations have not caused significant tree mortality due to the fact that no long term storage operations have yet occurred in the late spring or summer during the peak of the growing season.

Impoundment and subsequent drawdown in the reservoir tend to cause accumulations of woody debris at the log boom and intake gates. Therefore it is important that slash, logging debris and other material resulting from thinning, harvesting, and fuelwood cutting be handled in ways that will minimize maintenance problems at the dam.

Only a small number of acres of forest land below spillway crest is owned by the Federal Government, the majority of the land is owned by the MDC with the Corps of Engineers holding a flowage easement.

Short Range Forest Management Programs

Programs that will be implemented in the future are detailed in the following paragraphs.

Plantings

The large sand areas adjacent to dikes 2 and 3 in Compartment 2 have been planted with hybrid poplars (Populus spp.) and Austrian pine (Pinus nigra). However, the extreme dryness of the soil and high summer temperatures have cause considerable mortality. These areas should be replanted with established transplant stock and the seedlings fertilized and mulched with either wood chips or saw dust. The use of sweet fern, Comtonia pergrina, can also stabilize these areas. Periodic watering may be necessary.

Timber Stand Improvements

The red pine plantations (type P15) that exist at Barre Falls have not been treated in the past resulting in their having a high basal area per acre of 150+ sq. ft.; low live crown ratio of 20%; and a low growth rate. The stands located in Compartment 2 will receive a crop tree release. Intermediate and poor form codominants will be harvested in order to salvage the trees that might eventually die, and to stimulate the growth of the remaining trees. One desirable by-product of such an operation will be the seeding in of tolerant white pine from trees adjacent to the treated stands. The stands should not be opened up to a degree that

would stimulate the growth of intollerant species such as gray birch and pin cherry (Prunus pennsylvanica). The red pine stands in Compartment 2 are generally protected from the wind by the surrounding natural forest and blow down losses of the trees remaining after the thinning should not be severe.

A large portion of the red pine stand in Compartment 1 is located in an exposed hillside with a high water table. Extensive blow down has occurred and continues to occur. Most of this stand will be removed and portions allowed to revegetate naturally, be developed as a wildlife food plot, leased for agriculture, or used for a tree and shrub nursery for the Corps. The better protected areas of this stand occurring along the river will be treated to the same kind of moderate low thinning as recommended for the stands in Compartment 2.

The pine stands 20-3-A, 21-3-A and 21-5-B contain a large quantity of mature to overmature trees, 20"-34" in diameter, of "rough" or low quality. These stands would benefit by opening up the canopy with a commercial timber harvest thus reducing the basal area. Large volumes of sawlogs could be obtained from this commercial operation.

Young, good quality white pines released during these operations will be pruned to a height of 16 feet in order to produce better quality lumber for the future.

Types 16, 19, 20, 25 and 52 could benefit from light thinnings and cleanings. A fuelwood permit program will be used to carry out the needed work in accessible areas and commercial operations used where access is a problem.

Persons issued fuelwood permits should understand that their cutting is part of a planned timber stand improvement program. It may be desirable to prepare a brochure, with the assistance of a competent forester, outlining the management objectives and the importance of preventing damage to seedlings and trees to be left. Such a brochure could be provided along with the fuelwood permit.

Long Range Management Program

Areas should be treated to produce good quality trees of desirable species. Cuttings would stimulate regeneration of not only trees but also herbaceous plants of value for wildlife food and cover.

With proper management the entire forest could be sustained on a long term basis and yield not only cordwood and sawlogs but also improve wildlife habitat while protecting the aesthetics and water shed values of the land at the Barre Falls Dam.

Any timber removal will be coordinated with project personnel and project operations forester. At no time will the aesthetic and ecological quality of the project be placed in jeopardy.

Aesthetics

The aesthetics of the Barre Falls Dam area are very important and must be protected. All silvicultural operations will be performed to improve or at least impart no long term adverse influence on the aesthetics of the area. Clearcutting will not be a favored practice in timber removal. Buffer zones and cautious tree removal practices will be employed to assure proper vegetative cover.

Monitoring of Forest Conditions

The general conditions and trends of the forests at the dam must be monitored periodically to assess the effectiveness of silvicultural operations and the need for further treatments. The forests should be checked regularly for signs of developing disease and insect problems so that corrective actions can be undertaken if necessary.

Management Direction

All timber stand improvement and other silvicultural operations will be implemented under the direction of the LCRB Park Ranger/forester. Although the project boundaries have been delineated with monuments, blazes and/or paint should be used to clearly mark the limits of Federal land between monuments in areas where cutting under the fuelwood permit program or under contract is to be done. The Lower Connecticut River Basin forester will specify stand prescriptions and mark trees to be cut prior to undertaking cultural work.

SECTION 5. FISHERIES MANAGEMENT

Existing Management

Fisheries management at the Barre Falls Dam is performed under a license agreement by the Massachusetts Division of Fisheries and Wildlife. The existing fisheries management in the Barre Falls area is directed towards providing a put and take trout fishery. These fish are stocked in the spring and include numbers of brook trout (Salvelinus fontinalis), brown trout (Salmo trutta) and rainbow trout (Salmo gairdneri). Generally, the numbers stocked vary according to availability of stock from the hatcheries. Depending upon water levels and stock availability, fish may also be stocked in the fall. There is no information regarding angler utilization of the stocked fish as a creel census has yet to be carried out. In 1979 fish were stocked according to the following rate:

Number	Species
1150	Brook Trout
1450	Brown Trout
1750	Rainbow Trout

The fish are generally stocked in lengths between 9" and 12".

There is no management of warm-water fisheries in the area. Warm water species present include yellow perch (Perca flavescens), brown bullhead (Ictalurus nebulosus), chain pickerel (Esox niger), and largemouth bass (Micropterus salmoides).

Habitat

The principal factor influencing fish management is the nature of the habitat. Much of the area upstream of Barre Falls Dam consists of meandering streams flowing through open and shrubby swamps. However, the Ware River becomes a fast moving stream as it drops approximately 60 feet in elevation in the three quarter mile distance below the dam to the Corps of Engineers boundary.

Low summer flows, high water temperatures in the Ware River at the dam and heavy fishing pressure prevents a self-supporting trout fishery which would meet angler demand.

Water Quality

The watershed of the Ware River is under MDC jurisdiction and is protected as a source of public drinking water.

The Ware River, from its headwaters to a point 12 miles downstream from Barre Falls dam, is classified by the Commonwealth of Massachusetts as a Class A stream. Such waters are designated for use as public water supplies and are of uniformly excellent character. Objectives stated for

Class A streams include that dissolved oxygen concentrations cannot be less than 75 percent saturated during at least 16 hours of any 24-hour period and not less than 5 mg/l at any time. No increase in temperature, pH, color, turbidity, taste, and odor, other than what naturally occurs is permissible. Total coliform bacteria cannot exceed an average value of 50 counts in 1/100 ml during any monthly sampling period.

The Corps of Engineers has regularly monitored the quality of the water passing through the dry bed reservoir since 1970. The mean dissolved oxygen levels for a nine-year period (1970-1978) at all three sampling stations (two upstream and one downstream from the dam) are all at or over the 90 percent saturation value.

Chemical characteristics of the portion of the Ware River located in the project area reflect the presence of a significant number of swamps upstream from the dam. The mean pH values vary from 5.9 to 6.1 at the three sampling stations. The water is colored and has elevated concentrations of ammonia, phosphate, iron, and possibly zinc; the data on these metals are not conclusive. High levels of iron and zinc may be due to the acidic nature of the water and the complexing tendencies of these metals with humic substances found in waters that have passed through swamps.

Pesticides

The use of pesticides at the Barre Falls Dam has been limited to the herbicide HYVAR X6, which is used to control vegetation on the rock faces of the dam and dikes and in the emergency spillway. When applied according to the constraints set by the Environmental Protection Agency this chemical will have limited effects on aquatic species.

Aquatic Weeds

No extensive areas of aquatic weed growth occur on the project area which would have an injurious effect on aquatic species.

Access and Fishing Pressure

Fishing in the Ware River on Federal Government land is generally in the immediate vicinity of the dam. A small parking area at the east end of the dam is available to fishermen. Fishing pressure is heaviest following stocking by the Massachusetts Division of Fisheries and Wildlife, in the spring and early summer and is very light the rest of the year.

Short and Long Range Management

The state trout stocking program should be continued. At this time no other fishery management practices would improve or appreciably alter the aquatic resource.

SECTION 6. WILDLIFE MANAGEMENT

Major Species

Wildlife that can be seen in the area include whitetail deer (Odocoileus virginianus), red fox (Vulpes fulva), raccoon (Procyon loter), porquipine (Erethizon dorsatum), woodchuck (Marmota monax), snowshoe hare (Lepus americanus), cottontail rabbit (Sylvilgus floridanus), beaver (Castor canadensis), skunk (Mephitis mephitis), and muskrat (Ondatra zibethica).

Upland bird species include woodcock (Philhela minor), and ruffed grouse (Bonasa umbellus). Ring-necked pheasants (Phasianus colchicus) are stocked for the fall hunting season. There have been no rare or endangered species reported in the project area.

Existing Management

The Barre Falls project contains 557 acres which are surrounded by 21,000 acres of watershed land owned by the Metropolitan District Commission (MDC). These two properties are managed as one unit, the Barre Falls Management Area, by the Massachusetts Division of Fisheries and Wildlife.

On the average the state stocks 25 snowshoe hare and 1700 ring-necked pheasants on the area. As part of the wildlife management and habitat improvement program a few acres of open space and edge on MDC land are maintained by mowing, brush-cutting, and top dressing. MDC land adjacent to Corps property has been leased by the State to local farmers to grow corn, a portion of which is left to provide food to wildlife.

Forest Management Effects on Wildlife

Timber stand improvements such as thinnings and small clearcuts may result in increased production of wildlife through enhanced habitat for those species which take advantage of the new herbaceous and woody plant growth. Harvesting and thinning will be used to increase and improve mast production. Small clearcuts will favor aspen, cherry, birch and other intolerant species commonly used by many animals.

Wetlands Management

There are several wetland areas throughout the area. The management of these areas will be according to their classification in the National Wetlands Inventory of the U.S. Department of the Interior, Fish and Wildlife Service. Wetlands are very sensitive to human activities, and must be carefully protected. Management should be directed toward maintaining plant food species and preserving nesting areas.

Hunter Access and Designation of Hunting Areas

Hunter access is ample. Several roads and the Mid State Hiking Trail cross the Management Area. Due to the erosion in Compartment 2, the area has been closed to vehicles, however foot access is available.

According to Massachusetts law, areas within 150 feet of hard-surfaced highways or within 500 feet of buildings are closed to hunting. All other areas at Barre Falls are open to hunting.

Wildlife Observation

Beyond the economic and sporting value of numerous wildlife species, Barre Falls fauna have an aesthetic value for those interested in wildlife observation. Small mammals and birds residing on the fringes of picnic areas, along the roadsides and dam are perhaps the more noticeable resident creatures. Visitation by sightseers will be enhanced by good cultural practices aimed at creating adequate food, cover and water conditions for wildlife near these sites.

In Compartment 2, the foot-traveler is provided a good overlook of Blood Swamp from atop dike 3. The Mid-State Hiking Trail passes through Federal land and is used regularly by visitors for wildlife observation (Exhibit B, Map 3).

Short Range Management Programs

The wetlands just upstream of the dam offer good potential for waterfowl habitat improvement. Wood duck boxes will be erected there and in other wetlands in the area. The placing of these boxes, as well as boxes for bluebirds, kestrels and purple martins cost little, are easily built, require little maintenance and attract colorful birds that are enjoyed by visitors.

The continuing attempt to prevent disruption of the vegetation in the borrow areas by keeping the area barricaded and patrolled by law enforcement personnel is recommended. ORV use has lessened in these areas and these areas will be planted to provide additional habitat and cover for wildlife.

For the present time wildlife management will be concentrated mainly in those areas designated on the Wildlife Habitat Map (Exhibit B, Map 2).

Long Range Management

An essential element to any successful wildlife management program is the continuing control and maintenance of a wide range of habitat types. Den trees, old orchard apple trees, emerging vegetation and forest successional types will be kept in a harmonious balance to perpetuate the greatest diversity of species occurring at Barre Falls.

Steps should be taken to insure that operators engaged in various forestry-related activities are informed of (1) the effects the activities may have on wildlife and (2) the proper methods of carrying out the harvesting activities to minimize habitat damage. Specific examples include: protection of uncut trees, shrubs, and seedlings from damage during thinning or harvesting; require logging slash to lie close to the ground, and in some cases piling slash for wildlife cover; and leaving occassional cull trees for mast production or as den trees for wildlife. These kinds of information can be conveyed to contractors through detailed specifications, to project personnel through training sessions, and to individuals issued fuelwood permits through a brochure and explanation by C.E. representatives.

SECTION 7. RESEARCH NEEDS

Rare, Endangered, and Unique Species

Generally, rare species are associated with rare habitat types or have exacting requirements with respect to a host of environmental factors. No rare or endangered species were found as the habitat represented at Barre Falls Dam is not uncommon to the general surrounding area. It is possible that species of special concern do exist or pass through the project. Before any intensive forest mangement activities are carried out, the operating areas should be examined for the presence of rare species, especially plants. As information is developed, areas should be mapped to guide future management efforts.

SECTION 8. PERSONNEL AND FUNDING REQUIREMENTS TO IMPLEMENT PLAN

Forest Management

Personnel

1-GS-7 Park Ranger for 50 days = $4,000. Plan layout and administer contracts for the removal of forest products, fuelwood permit program, planning, revision of plan. Every year.

2-WG-5 Laborers for 15 days = $1,920. Revegetation in Comp. 2.

Equipment

1/4 x 2 P/U truck for transportation
#30/day for 50 days = $1,500, every year.

Plant materials and fertilizer and mulch $3,000 to revegetate sandy areas in Compartment 2.

Fish and Wildlife Management

Personnel

1 GS-7 Park Ranger for 10 days = $980. Coordinate, construct and install nesting boxes, revise plans and conduct research. Every year.

Equipment

1/4 x 2 P/U truck for transportation
$30/day for 10 days = $300

Other

State management and trout stocking: $6,000 - $7,000 annually.

SECTION 9. INITIAL WORK PLAN

A tentative plan for carrying out specific management activities is as follows:

Year 1:	TSI in red pine plantations (P15 type). Revegetate denuded areas in Compartment 2.
Year 2:	Investigation of bird nesting boxes. Fuelwood permit program.
Years 3-5:	Commercial thinning and selective cutting in white pine (20-21 types). Fuelwood permit program.

Annual Work Plan

Annual work plans will be developed in detail for a five year period and updated annually. Work plans will be consistent with the overall objectives of the management plan and available funds.

Disposal Plan

When commercial thinning and selective cutting operations are carried out and the forest products are determined to be surplus to project needs, a disposal plan will be prepared.

EXHIBIT A. TABLES

TABLE 1

Land Classification and Forest Types

	ACRES		
	Compartment 1	Compartment 2	Total
Project Operation	20	11	31
Wetland	10	5	15
Sand/Gravel	1	26	27
Water	7	-	7
Abandoned Fields	8	10	18
Forest	146	313	459
TOTALS	192	365	557
Forest Types			
Red Pine Plantation			
P15-2-1	1	-	1
P15-3-A	30	71	101
Aspen			
16-1-A	-	5	5
16-1-C	8	2	10
16-2-A	9	16	25
16-2-B	-	2	2
16-3-A	-	10	10
Gray Birch - Red Maple			
19-2-A	3	3	6
19-3-A	-	3	3
White Pine - N. Red Oak-White Ash			
20-2-A	2	1	3
20-3-A	31	76	107
White Pine			
21-2-A	1	2	3
21-3-A	22	94	116
21-4-A	2	4	6
21-5-B	6	-	6
21-3/C/16-2-A	-	3	3
21-4-C/20-3-A	-	9	9
Hemlock			
23-3-A	3	-	3
Sugar Maple-Beech - Yellow Birch			
25-3-A	17	-	17
White Oak-Red Oak-Hickory			
52-3-A	11	12	23
TOTALS	146	313	459

TABLE 2

COMPARTMENT 1

Timber Volume Estimate for Invidual Species And Forest Cover Types

Forest Type	Acres	White Pine	Red Pine	Hemlock	White Oak	Red Oak	Red Maple	Sugar Maple	Yellow Birch	Paper Birch	Black Cherry	Total	Average BF/Acre
BOARD FEET INTERNATIONAL 1/4 INCH RULE													
P15-3-A	30	26400	304950				6210					331350	11045
19-2-A	3	2382										8592	3864
20-2-A	2	8194			2304						432	10930	5465
20-3-A	31	93372		25774	9951	56327	7998				3999	197421	6368
21-2-A	1	980										980	980
21-3-A	22	189662			1716		3542				3894	211988	9636
21-4-A	2	29616		514								30130	15065
21-5-A	6	178530										178530	29755
23-3-A	3			22251	9459							35631	11877
25-3-A	17	22287										83725	4925
52-3-A	11	14421			21120			40018	8007	13413		69894	6354
TOTALS	128	565844	304950	48539	44550	107775	17750	40018	8007	13413	8325	1159171	

TABLE 3

COMPARTMENT 2

Timber Volume Estimate For Individual Species And Forest Cover Types

Forest Type	Acres	White Pine	Red Pine	Hemlock	White Oak	Red Oak	Red Maple	Black Cherry	Black Spruce	Total	Average BF/Acre
BOARD FEET INTERNATIONAL 1/4 INCH RULE											
P15-3-A	71		721715							721715	10165
19-2-A	3	2382					6210			8592	2864
20-2-A	1	4097		1152	1152			216		6617	6617
20-3-A	76	228912		14425	24396	138092	19608	9804		435237	5727
21-2-A	2	1960								1960	980
21-3-A	94	810374			7332	29145	15134	16638	10617	889240	9460
21-4-A	4	59332		1028						60260	15065
21-3-C/16-2-A	3	1302								1302	434
21-4-C/20-3-A	9	26982								26982	2998
52-3-A	12	15732			23040					76248	6354
TOTALS	275	1150973	721715	16605	55920	204713	40952	26658	10617	2228153	

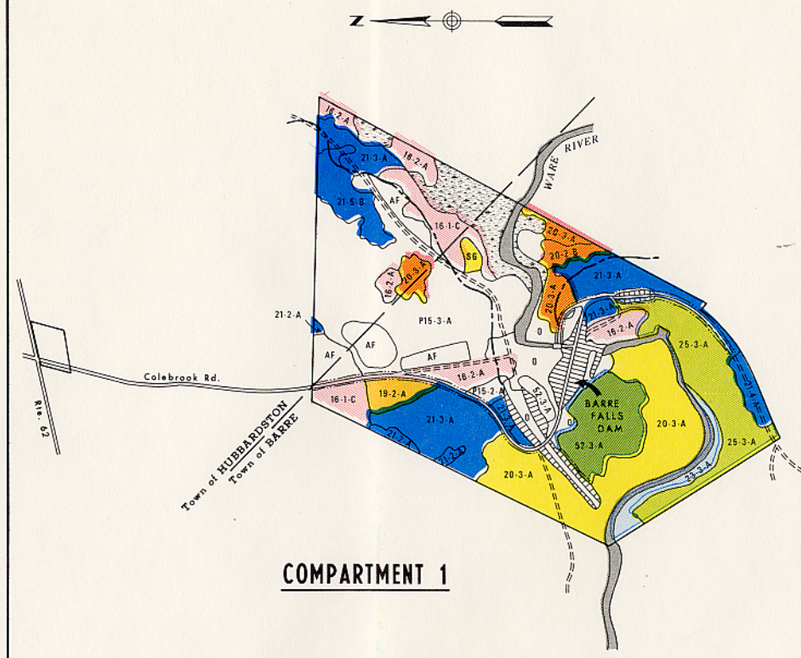
TABLE 4

BARRE FALLS

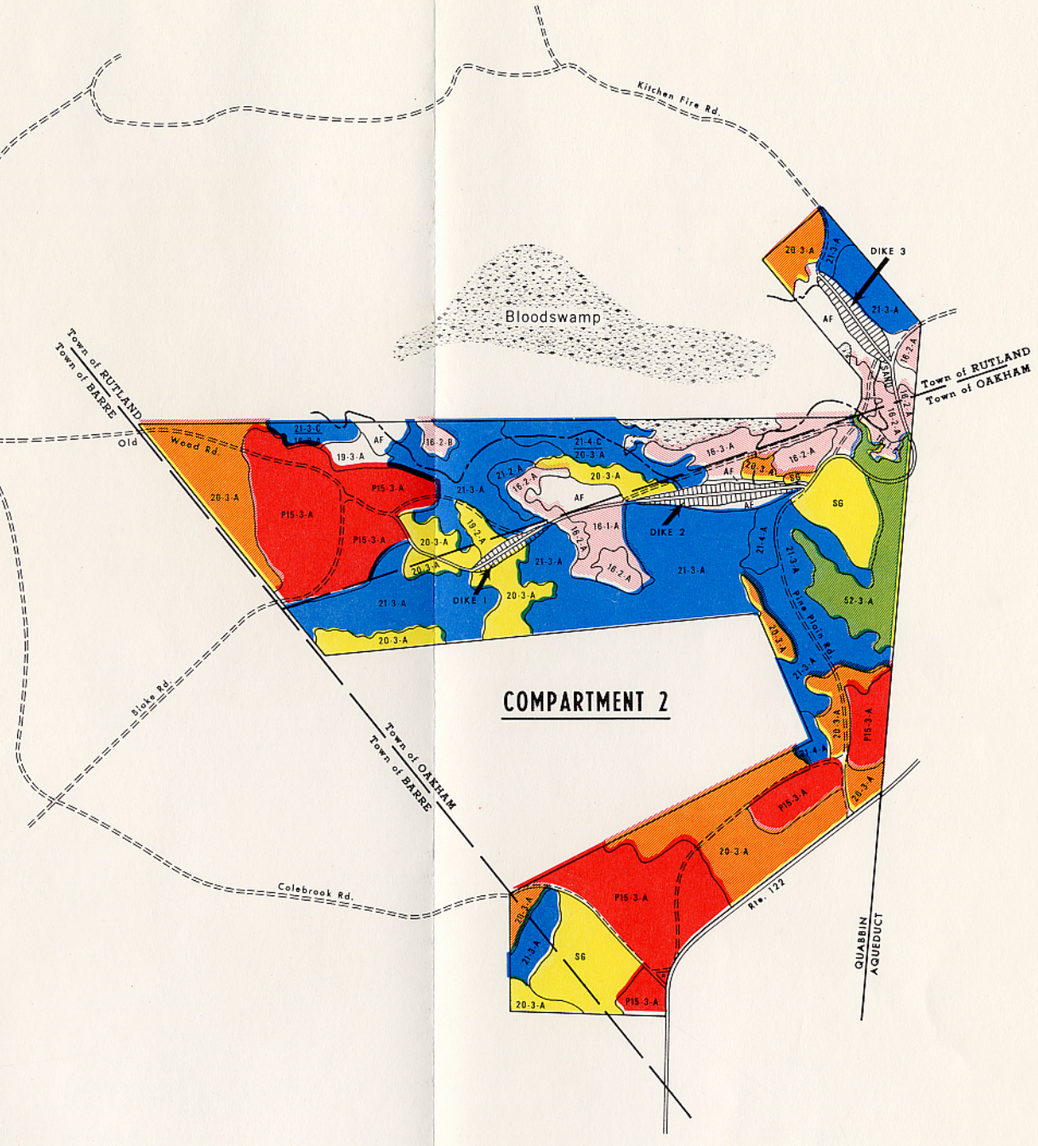
Total Timber Volume Estimate for Individual Species
Board Foot Internation 1/4 Inch Rule

White Pine	1,716,817
Red Pine	1,026,665
Hemlock	651,144
Red Oak	312,144
White Oak	100,470
Red Maple	58,702
Sugar Maple	40,018
Black Cherry	34,983
Paper Birch	13,413
Black Spruce	10,617
Yellow Birch	8,007
TOTAL	3,387,324

EXHIBIT B. MAP



COMPARTMENT 1



COMPARTMENT 2

S.A.F. COVER TYPES AND LAND CLASSIFICATION

- P15 — Red Pine Plantation
- 16 — Aspen
- 19 — Grey Birch-Red Maple
- 20 — White Pine-Northern Red Oak-Hickory
- 21 — White Pine
- 23 — Hemlock
- 25 — Sugar Maple-Beech-Yellow Birch
- 52 — White Oak-Red Oak-Hickory
- Swamp-Marsh-Other Wetland
- AF — Abandoned Field/Brush
- O — Open/Lawn
- SG — Sand/Gravel
- Dam/Dikes

EXAMPLE: 21 — 3 — A

- 21 — S.A.F. Cover Type
- 3 — Height Classes
  - 1–0'–20'
  - 2–20'–40'
  - 3–40'–60'
  - 4–60'–80'
  - 6–Mixed
- A — Stocking (% Crown Closure)
  - A–81–100
  - B–61–80
  - C–41–60

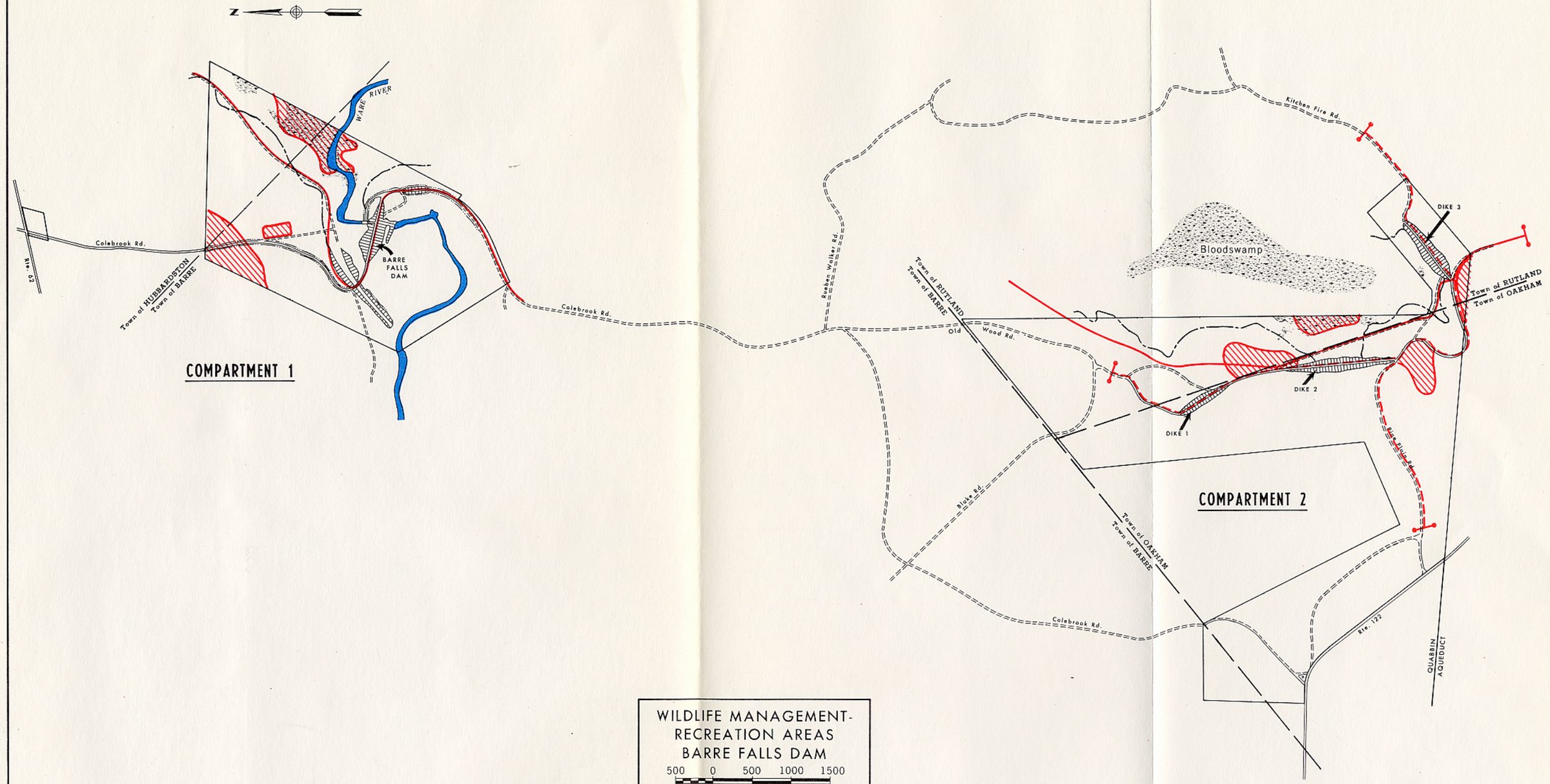
FOREST COMPARTMENTS AND COVER TYPES OF BARRE FALLS DAM

500 0 500 1000 1500

LEGEND

- Paved Road
- Gravel Road
- River
- Flow Line at Spillway Crest (807.0 M.S.L.)
- Town Line
- Outline of CE. Property
- Forest Type Boundary

EXHIBIT B



WILDLIFE MANAGEMENT-
RECREATION AREAS
BARRE FALLS DAM

500 0 500 1000 1500

SYMBOLS

- Midstate Hiking Trail
- Wildlife Management Areas
- Road Gate
- Motorized Vehicles Prohibited

LEGEND

- Paved Road
- Gravel Road
- River
- Flow Line at Spillway Crest (807.0 M.S.L.)
- Town Line
- Outline of CE. Property
- Forest Type Boundary

EXHIBIT B